

WHAT IS CLAIMED IS:

1 1. A method of revascularizing a portion of a
2 patient's myocardium comprising:
3 positioning an active electrode surface in close
4 proximity to a target site on a wall of the patient's heart;
5 and

6 applying high frequency voltage between the active
7 electrode surface and a return electrode to ablate tissue at
8 the heart wall and to form a revascularizing channel through
9 at least a portion of the heart wall.

1 2. The method of claim 1 further comprising
2 axially translating the active electrode surface through a
3 portion of the heart wall to form the revascularizing channel.

1 3. The method of claim 1 further comprising:
2 introducing at least a distal end of an
3 electrosurgical catheter into the ventricle of the heart; and
4 positioning the distal end of the catheter in close
5 proximity to the endocardium.

1 4. The method of claim 1 further comprising:
2 introducing at least a distal end of an
3 electrosurgical probe through an opening in the patient's
4 chest cavity; and
5 positioning the distal end of the probe in close
6 proximity to the epicardium.

1 5. The method of claim 4 wherein the probe is
2 introduced through an intercostal penetration in the patient.

1 6. The method of claim 1 wherein the voltage is
2 applied continuously between the active and return electrodes.

1 7. The method of claim 1 wherein the voltage is
2 applied in pulses to correspond to beating of the patient's
3 heart.

1 8. The method of claim 1 wherein the active
2 electrode comprises an electrode array including a plurality
3 of isolated electrode terminals.

1 9. The method of claim 1 wherein the active
2 electrode comprises a single electrode protruding from a
3 distal end of an electrosurgical probe.

1 10. The method of claim 8 further including
2 independently controlling current flow from at least two of
3 the electrode terminals based on impedance between the
4 electrode terminal and the return electrode.

1 11. The method of claim 1 further comprising
2 forming a revascularizing channel with a lateral dimension of
3 about 1.5 to 3.0 mm.

1 12. The method of claim 1 further comprising
2 positioning a radially expandable luminal prosthesis in the
3 revascularizing channel to maintain patency of the channel.

1 13. The method of claim 1 wherein the channel
2 formed by the active electrode surface is curved.

1 14. The method of claim 13 wherein the channel
2 formed by the active electrode surface has first and second
3 openings on one side of the heart wall, and a substantially U-
4 shape therebetween.

1 15. The method of claim 8 wherein the electrode
2 terminals are embedded in an insulating matrix to electrically
3 isolate each terminal, the insulating matrix comprising an
4 inorganic material.

1 16. The method of claim 8 wherein the return
2 electrode is proximally recessed from the active electrode
3 terminals.

1 17. The method of claim 8 wherein the return
2 electrode and the active electrode terminals are disposed on a
3 distal surface of an electrosurgical probe.

1 18. The method of claim 1 further comprising
2 controlling the depth of the revascularizing channel.
3

4 19. The method of claim 18 further comprising
5 visually marking the target site on the heart wall.

1 20. The method of claim 18 further comprising
2 determining a thickness of the heart wall at the target site.

1 21. The method of claim 18 further comprising
2 setting a predetermined distance through the heart wall at the
3 target site and interrupting the flow of voltage to the active
4 electrode surface when said active electrode surface has
5 advanced the predetermined distance to control the depth of
6 the channel.

1 22. The method of claim 20 wherein the determining
2 step comprises measuring tissue impedance beyond the distal
3 end of the active electrode surface.

1 23. The method of claim 1 further comprising the
2 step of determining when the active electrode surface has
3 substantially penetrated through the heart wall.

1 24. The method of claim 23 further comprising
2 terminating the high frequency voltage before the active
3 electrode surface pierces an opposite wall surface of the
4 heart wall.

1 25. A method of transmyocardial revascularization
2 of the heart of a patient comprising:

3 positioning a distal end of a probe in close
4 proximity to a target site on a wall of the patient's heart;
5 and

6 applying energy to the heart wall to ablate tissue
7 at the heart wall while axially translating the distal end of
8 the probe through at least a portion of the heart wall to form
9 revascularizing channel through the heart wall.

1 26. The method of claim 25 wherein the probe is
2 axially translated through at least a portion of the heart
3 wall at a substantially constant rate.

1 27. The method of claim 25 further comprising means
2 for automatically translating the probe through a substantial
3 portion of the heart wall.

1 28. An electrosurgical device for transmyocardial
2 revascularization of a patient's heart tissue, the device
3 comprising:

4 an instrument shaft having a proximal and distal end
5 portions, the distal end portion being sized for delivery
6 through a small revascularizing channel in the patient's
7 heart;

8 one or more active electrodes disposed on the distal
9 end portion;

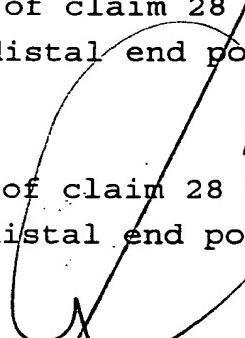
10 a return electrode disposed on the shaft close to
11 the active electrodes; and

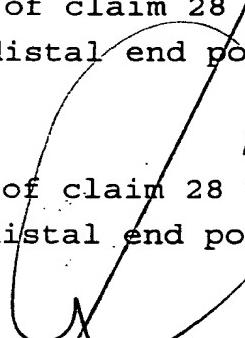
12 a connector disposed near the proximal end portion
13 of the shaft for electrically coupling the active and return
14 electrodes to a high frequency voltage source to ablate tissue
15 at the heart wall and to form a revascularizing channel
16 through at least a portion of the heart wall.

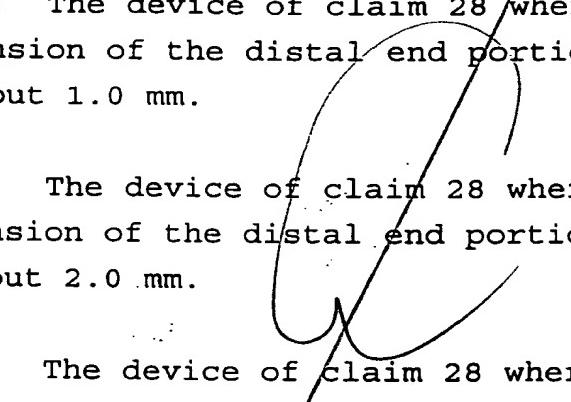
1 29. The device of claim 28 wherein the shaft is a
2 catheter shaft configured for endoluminal delivery into the
3 patient's ventricular cavity.

1 30. The device of claim 28 wherein the shaft is a
2 probe shaft configured for intercostal delivery into the
3 thoracic cavity.

1 31. The device of claim 29 further comprising an
2 electrode array disposed at the distal end of the shaft and
3 including a plurality of isolated electrode terminals, wherein
4 current flow from at least two of the electrode terminals is
5 independently controlled based on impedance between the
6 electrode terminal and the return electrode.

1 32. The device of claim 28 wherein the maximum
2 lateral dimension of the distal end portion of the shaft is
3 less than about 1.0 mm.


1 33. The device of claim 28 wherein the maximum
2 lateral dimension of the distal end portion of the shaft is
3 less than about 2.0 mm.


1 34. The device of claim 28 wherein the electrode
2 terminals are embedded in an insulating matrix to electrically
3 isolate each terminal, the insulating matrix comprising an
4 inorganic material.


1 35. The device of claim 28 wherein the return
2 electrode is proximally recessed from the active electrode
3 terminals.

1 36. The device of claim 28 wherein the return
2 electrode and the active electrode terminals are disposed on
3 a distal surface of the shaft.

1 37. The device of claim 28 further comprising an
2 array of return electrodes on a distal surface of the shaft
3 and having an opposite polarity from the active electrodes.

1 38. The device of claim 28 wherein the distal end
2 of the shaft has a conical surface; the electrode terminals
3 extending axially from the conical surface.

1 39. The device of claim 28 further comprising a
2 guide catheter having a flexible steerable shaft for
3 delivering the instrument shaft through a percutaneous
4 penetration into the ventricular cavity.

1 40. The device of claim 28 further comprising a
2 plurality of impedance monitors coupled to the electrode
3 terminals for determining impedance between each individual
4 electrode terminal and the return electrode.

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